# Eli Sternberg

1917–1988

By Bernard Budiansky and James K. Knowles

Eli Sternberg, the nation's leading elastician, died suddenly on October 8, 1988, in Pasadena, California, just a few weeks before his seventy-first birthday. He had served as a member of the faculty of the California Institute of Technology for over two decades, becoming professor of mechanics emeritus in June 1988.

Sternberg was born in Vienna, Austria, on November 13, 1917. He completed his high school education at Vienna's Realgymnasium in 1936 and then enrolled in the Technische Hochschule of Vienna as a student of architecture. Two years later, when his studies were abruptly interrupted by the Nazi invasion of Austria, Sternberg made his way, alone, to London, with the assistance and encouragement of his family. There he restarted his college studies, this time in engineering, at the University of London. The following year he emigrated to the United States, continued his education at North Carolina State College, and received his B.S. in civil engineering in 1941. Graduate work at the Illinois Institute of Technology (IIT) followed, with a Ph.D. in mechanics conferred in 1945. In the same year, he became a United States citizen.

Sternberg remained at IIT as a faculty member, becoming a full professor in 1951. In 1957, following a yearlong visiting professorship in the Technische Hogeschool of Delft in the Netherlands as a Fulbright fellow, he joined the Division of

Applied Mathematics of Brown University as professor of mechanics. A sabbatical year in Japan as a Guggenheim fellow preceded his last academic migration, to the California Institute of Technology, where he was appointed professor of mechanics in the Division of Engineering and Applied Science in 1964.

Eli Sternberg's worldwide reputation as a leading scholar and researcher in the theory of elasticity became well established within a very few years after he started his professional career. His earliest postdoctoral research contributions, on stress concentrations around holes and cavities, carried the stamp of depth, elegance, authority, rigor, and precision that was to characterize all his later work. A rich variety of research topics in the theory of elasticity attracted Sternberg's probing interest during the ensuing decades: singular solutions associated with load and geometry discontinuities; static and dynamic thermoelasticity; viscoelasticity; thermoviscoelasticity; load transfer and load diffusion in fiber-reinforced materials; finite-deformation effects on stress singularities; and the breakdown of uniqueness in stress and displacement fields.

A superb mathematical analyst, Sternberg, throughout his career, not only provided explicit solutions to specific, basic problems of engineering importance but also contributed in fundamental ways to the foundations of the subjects with which he was concerned. Thus, while the early 1952 paper that Sternberg wrote (with his student F. Rosenthal) on the stresses and deformations in an elastic sphere under concentrated loads provided, for the first time, the solution to a problem of technological importance, it also led Sternberg to the incisive, rigorous formulation of general classes of problems involving load concentrations. This work preceded his trenchant study of the widely quoted but imperfectly understood St. Venant principle of the theory of elasticity. In a now-classic 1954 paper, Sternberg gave mathematical form and proof to von Mises'version of this principle. Conditions for the validity and completeness of mathematical representations of general solutions of elasticity theory were established by Sternberg (together with his student Eu-banks) in an important 1956 paper; and the analagous questions for elastodynamics were treated definitively by Sternberg in his

monumental paper of 1960, "On the Integration of the Equations of Motion in the Classical Theory of Elasticity." Similarly, the general theories of thermoelasticity, viscoelasticity, and nonlinear elasticity are supported at their cores by theorems and formulations of permanent value that are due to Sternberg and his collaborators.

Some of these fruitful collaborations are particularly noteworthy. For more than a dozen years, Sternberg worked with R. Muki on a variety of topics that included thermal stress problems, couple-stress effects on singular stress fields, and load transfer in fiber-reinforced composites. Together with his student M. E. Gurtin, he explored special and general problems in static and dynamic elasticity, thermoelasticity, and viscoelasticity over a period of several years of intense activity. And a nearly quarter-century-long collaboration with J. K. Knowles that started soon after Sternberg arrived at Caltech was largely devoted to nonlinear singular problems and fundamental questions concerning loss of ellipticity in finite elasticity.

Eli Sternberg's scientific achievements earned him tremendous respect from the applied mechanics community the world over. He was greatly admired for the purity of thought, the depth of perception, and the high level of clarity and conviction that he achieved in scientific exposition. In addition to membership in the National Academy of Engineering, overt recognition came repeatedly, with election to the National Academy of Sciences and the American Academy of Arts and Sciences; the conferral of honorary doctorates from North Carolina State University and the Technion of Israel; and the award of the Timoshenko Medal of the American Society of Mechanical Engineers. A marvelous speaker, he was constantly in demand as a lecturer on his research, and he held numerous distinguished invited lectureships throughout his career.

Although a recital of Eli's contributions to engineering science and of the honors and acclaim bestowed upon him may suffice to delineate the distinction of his professional career, there were dimensions of charm, humor, warmth, and worldly perception in his personality and character that made him a much-loved colleague who will long be remembered as a won

derful person who enriched the lives of all who knew him. A tall, imposing, gentlemanly presence, he brought to everyday discourse an elegance of expression and happy turn of phrase that made simply being in his company a joy. He had a special gift for recognizing and sharing with his friends and colleagues the ironies, contradictions, absurdities, and affectations of life in science and in academia. His bon mots were legendary. Concerning the perennially deplored academic dictum to "publish or perish," he pointed out that one method of coping has often been to "publish perishables." On the same subject, he once referred to the "statistical validity" of the publication list of an especially prolific engineering researcher: "He has published so many papers that there is a statistical chance that some of them are right." Alluding to the immaculately kept desk of another professor: "As soon as some trash accumulates there, he publishes it!"

Uncompromisingly serious about the achievement and maintenance of high scientific merit in his own work and that of his students, Eli nevertheless exuded an infectious sense of pleasure in scientific discovery and in the achievement of understanding. The heartfelt devotion of Sternberg's students is due as much to the sympathy and understanding with which he guided their careers as it is to the science he taught them. While Eli undoubtedly had a clear understanding of the major role he played in applied mechanics, he was uncomfortable with praise, which he tended to dismiss, graciously but firmly. "As you know," he said, in accepting the Timoshenko medal, "medals—much like arthritis—are a common symptom of advancing years."

Sternberg is survived by his wife Rae, a Ph.D. in psychology in private practice; his daughter Eve, a city planner and consultant in economic development; and his son Peter, a mathematician on the faculty of Indiana University. He leaves a legacy of scientific contribution of high and enduring merit, and the memory of a treasured friend and colleague.